

PORTABLE COMMUNICATION DEVICE INTERFACE TO
A PROJECTION DISPLAY

Field of the Invention

This invention relates generally to telecommunications interfaces and, in particular,
5 to an apparatus for coupling a portable communication device, such as a cellular phone, to
a projection display, such as an automobile's windshield display.

Background of the Invention

Cellular phones have become significant players in a technological revolution. Since cellular phones first became available in the early 1980's, the number of people
10 owning them has increased yearly by approximately 40%. It is estimated that there are currently in the range of 80 million cellular telephone users in the United States alone. Cellular phones themselves have metamorphized from heavy, cumbersome, expensive devices to light, miniature, inexpensive units. Changes in the physical features of cellular phones have encouraged changes in when, where and how people use cellular phones.
15 Cellular phones and other portable communications devices have been key in making the populace more mobile and more sophisticated technologically.

PDA (personal digital assistant) is a term for any small mobile hand-held device that provides computing and information storage and retrieval capabilities for personal or business use. Many PDAs have a small keyboard; some have an electronically sensitive
20 pad on which handwriting can be received. Typically, PDAs are used for scheduling, keeping an address book and note-entering. Additionally, many applications have been written for PDAs. Increasingly, PDAs are combined with telephones and paging systems and now are commonly used to send faxes and e-mail. Most PDAs can connect to other computers, either through telephone lines, radio waves or a computer cable. Many PDAs
25 have PC card slots for attaching modems and other auxiliary devices.

Recent technological trends in mobile communications and computer hardware and software and the desire to work "on-the-road" have resulted in a move towards integration of technologies. Wireless communications can now be used to create a truly mobile office,

including the receipt of e-mail, fax and Internet services in addition to telephone, voice mail and paging capabilities on the portable communications device. Frequently, these services provide a string of text that is displayed on the wireless unit.

The reduced size, reduced cost and increased functionality of the cellular telephone, and the increased prevalence and popularity of PDAs have resulted in the increased use of cellular telephones and PDAs by drivers while driving. Because of the public's concern for safety on the roadways, however, the use of cellular phones and PDAs while driving is a subject of some controversy and considerable public and legislative concern. One way that safety issues are being addressed is the incorporation into vehicle design of a projection display, such as a so-called "Heads Up Display" (HUD). A HUD typically displays information translucently on the windshield so that the driver can look at the display of computer generated information without taking his eyes off the road.

The inventors are unaware of any way, however, by which textual data from a cellular phone or other portable communications device can be displayed on the automobile's windshield using the vehicle's projection display system. It would be advantageous to have such a device so that textual information from a cellular telephone, PDA, or other portable communications device could be displayed in such a fashion that the driver would be able to see the information without taking his eyes from the road. Likewise a need exists to have a mechanism by which the portable communications device is controlled, to be located in a site where the controls can be activated without the driver's eyes leaving the road.

Summary of the Invention

The present invention addresses the aforementioned needs by providing an interface between a portable communications device such as a cellular phone or personal digital assistant (PDA), and a remote projection display of a vehicle, in which a display is typically projected upon a vehicle's windshield. The interface enables textual or graphical data (information) delivered to the portable communications device to be displayed on the windshield of a vehicle. The interface includes at least one input port that accepts information from a portable communications device and at least one output port that

outputs information to the projection display. The interface may include a data formatter that converts the information received from the portable communications device into a form the projection display can display. The interface may also enable control of essential functions of the portable communications device to be integrated into controls on the 5 steering wheel. The interface may also be adapted to interface with a hands-free kit.

Brief Description of the Drawings

The foregoing summary, as well as the following detailed description of the preferred embodiments, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings 10 embodiments that are presently preferred, it being understood, however, that the invention is not limited to the specific apparatus and methods disclosed. In the drawings, like numbers refer to like elements throughout.

Fig. 1 depicts a preferred embodiment of a communications interface device according to the present invention communicatively connected to a personal 15 communications device and a projection display device.

Fig. 2 provides block diagrams of the various components of a preferred embodiment of a system employing a communications interface device according to the present invention.

Fig. 3 is a flow chart depicting steps employed with the cellular phone, cradle and 20 projection display of Figs. 1 and 2 in accordance with one embodiment of the present invention.

Detailed Description of Preferred Embodiments

Fig. 1 depicts a preferred embodiment of a system according to the present invention for displaying information at a remote projection display 142, based on signals 25 received by a portable communications device (PCD) 120. As shown in Fig. 1, PCD 120, which can be a cellular phone or personal digital assistant (PDA), for example, includes a signal receiving device 122, a PCD display 128, an information input interface 127, an audio output port 126a and a data output port 126b. As shown in Fig. 2, PCD 120 can also include a power supply 121, memory 123, and processor 124.

As is well known in the art, PCD 120 receives information-containing signals from a signal generating device, such as a cellular phone transmission tower, via signal receiving device 122, which is preferably an antenna. Antenna 122 is electrically coupled to processor 124, which converts the information contained in the signals received by 5 antenna 122 into a format that is suitable for display on display 128. PCD 120 may, in addition, include a GPS (Global Positioning System) unit (not shown).

User input interface 127 includes a plurality of buttons via which the user can communicate with PCD 120. Such communication can include inputting commands such as toggling power to the PCD, entering alphanumeric data, or selecting certain, predefined 10 functions. Such communication can also include scrolling through information displayed on display 128.

Output ports 126a and 126b enable PCD 120 to communicate with external devices. Preferably, output ports 126a and 126b are serial ports, although they can be parallel ports or USB ports depending on the PCD being used. Processor 124 can convert 15 data received from antenna 122 into a format capable of interpretation by various external devices including but not limited to a hands-free kit, a computing device and a projection display device. Those skilled in the art will understand that such conversion routines are well known in the art and thus will not be explained further herein.

Fig. 1 also depicts a projection display system 140, such as an automobile's Heads 20 Up Display (HUD), embedded in the vehicle's dashboard 24. Such systems are well known in the art. Projection display system 140 projects a translucent projection display 142 onto the windshield 22 of portion 20 of a vehicle (not shown), so that the driver can view the information on display 142 without having to take his eyes off the road.

As shown in Fig. 2, display system 140 can include one or more input ports 144a, 25 144b, *etc.*, a processor 146, and a display port 148. Display system 140 can receive input data from one or more data providers via input ports 144a, 144b, *etc.* Typical data providers can be the vehicle's on-board navigation system, speedometer, or thermometer, for example.

Processor 146 processes the received data and causes information based on the 30 received data to be displayed on projection display 142 in a user-readable format. For

example, an automobile's speedometer might generate electrical signals that are conveyed to processor 146 through input port 144a or 144b, etc. Processor 146 determines the speed of the automobile from information contained in the received electrical signals, and causes a numeric representation of the automobile's speed to be projected, via display port 148, 5 onto projection display 142 on the vehicle's windshield.

Preferably, projection display system 140 includes a user-control interface 152, which can be integrated into the vehicle's steering wheel 150. Control interface 152 can include scroll buttons 154 that allow the user to "scroll" up or down through the displayed information, and control buttons 156 that allow the user to toggle the display on and off, 10 for example. It is preferred that control interface 152 is integrated into the vehicle's steering wheel 150 so that the user will not have to take his eyes off of the road while manipulating the display system.

According to the present invention, PCD 120 is coupled to projection display system 140 so that whatever is displayed at PCD display 128 can be displayed 15 simultaneously or alternatively at projection display 142. In this way, the driver can view the information displayed at PCD display 128 without having to take his eyes off the road to do so. Accordingly, a system according to the present invention includes an interface device 130, which can be a housing or cradle, for example, that receives PCD 120 and couples PCD 120 to projection display system 140. The scroll controller may be 20 electrically connected to the remote projection display device.

Cradle 130 can be tailored (*i.e.*, sized and shaped) to receive PCD 120, and can include an appropriate connector 133 for coupling cradle 130 with PCD 120 such that cradle 130 can receive data output from PCD 120 via data output port 126b or both output ports 126a and 126b. Cradle 130 can also include an appropriate connector 134 for 25 coupling cradle 130 (and, therefore, PCD 120) to projection display system 140. In a preferred embodiment cradle 130 is adapted to connect to an RS232 connector on projection display system 140 via wires or cables 134. In another embodiment connector 134 may be a vendor-specific wiring harness. In another embodiment this connection can be wireless.

Cradle 130 includes at least one input port 138b for receiving data from PCD120 output data port 126b. Cradle 130 may also include an audio input port 138a (not shown) for receiving audio data from PCD 120 audio output port 126a. Cradle 130 also includes at least one output port 139b for sending data to projection display system 140. Cradle 5 130 may in addition include an audio output port 139a (not shown) for outputting audio data.

In a preferred embodiment, a voltage control switch 135 senses when PCD 120 has been received into cradle 130. In another embodiment, circuitry in cradle 130 senses when PCD 120 has been received into cradle 130. In a preferred embodiment, data received 10 from PCD 120 is transmitted to projection display device 140 whenever PCD 120 is received into cradle 130. In another embodiment, cradle 130 tells PCD 120 to send data to cradle 130.

As described above, PCD 120 receives information-containing signals from a signal-generation device. When PCD 120 is received into cradle 130, these signals are 15 output from PCD 120, via output ports 126a and/or 126b, and data is received by interface 130, for example, through serial port 138b (for data). In one embodiment interface 130 may in addition include a serial port 138a (not shown) for receiving audio data from PCD 120 from audio output port 126a and a speaker (not shown) for outputting audio data received through serial port 138a. Interface 130 may in addition include a microphone 20 (not shown) for receiving data that is to be sent back to the cell phone through an audio output port 139a (not shown) in cradle 130. Interface 130 transfers data from data serial port 138b to projection device 140 through connector 134 as discussed above.

In another aspect of the invention, controls 152 on a steering wheel 150 communicate with interface 130 via connector 136 to control aspects of how information 25 received by projection display 140 from interface 130 is displayed on display 142. For example, controls 152 on steering wheel 150 may control scrolling of information received from interface 130.

Cradle 130 may have its own power source (not shown), such as a battery or an AC power converter, and/or may derive its power from the received cellular phone 120. Of 30 course, if power use is more than minimal, it may be preferable that cradle 130 have its

own power source so as not to excessively draw down the battery of such cellular phone 120 and /or provide a power boost to the cellular phone 120.

Cradle 130 can also include a processor 132 for converting data received from PCD 120 from one format into another or to perform other processing tasks, such as determining 5 whether PCD 120 has been received into cradle 130. Such conversion processes are well known in the art and need not be described further. In an alternate embodiment, cradle 130 includes no processor.

In one embodiment cradle 130 connects to a hands-free kit. In such an embodiment, cradle 130 can be tailored (*i.e.*, sized and shaped) to receive a hands-free kit, 10 and can include an appropriate connector for coupling cradle 130 with hands-free kit. Hands-free kits are well known in the art and, therefore, are not described herein.

In operation, referring now to Fig. 3, the user thereof appropriately places such portable communications device 120 into cradle 130 at step 301 so that serial ports 126a and/or 126b of portable communications device 120 is coupled with serial port connectors 15 138a and/or 138b of cradle 130. In addition, such user appropriately couples cradle 130 to projection display device 140 by way of connector 134 (step 303) and performs whatever appropriate coupling is necessary (connecting a cable, for example).

Preferably, portable communications device 120 and processor 124 therein are programmed or wired to sense a connection to cradle 130. Alternatively, the user may 20 desire or be required to command cellular phone 120 to communicate with cradle 130. Thereafter, cellular phone 120 and processor 124 therein employ processor 132 to establish a connection wherein communication mode is entered (step 305) and communication with projection display device 140 by way of cradle 130 is established (step 311). By establishing two-way communication between cellular phone 120 and projection display 25 device 140, additional incoming and outgoing data (such as new messages and other information) may be composed and exchanged therebetween.

When the user wishes to end the session, such user may command cellular phone 120 to do so (step 313). Cellular phone 120 may also automatically end the session after a pre-determined period of inactivity, among other things. The user can then remove 30 cellular phone 120 from cradle 130 (step 315) and decouple cradle 130 from projection

display 140 by way of connector 134 (step 317). Preferably, upon sensing removal from cradle 130, cellular phone 120 and projection display device 140 return to normal operation.

The programming necessary to effectuate the present invention, such as the
5 programming run by the processor of the cellular phone 120, interface 130 and the
programming run by the projection display device, 140 is readily apparent to those skilled
in the relevant art.

As should now be understood, in the present invention, a method and apparatus are provided to support the display of textual information from a cellular phone on a projection display device. Changes could be made to the embodiments described above without departing from the broad inventive concepts thereof. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.